Experiment - 1

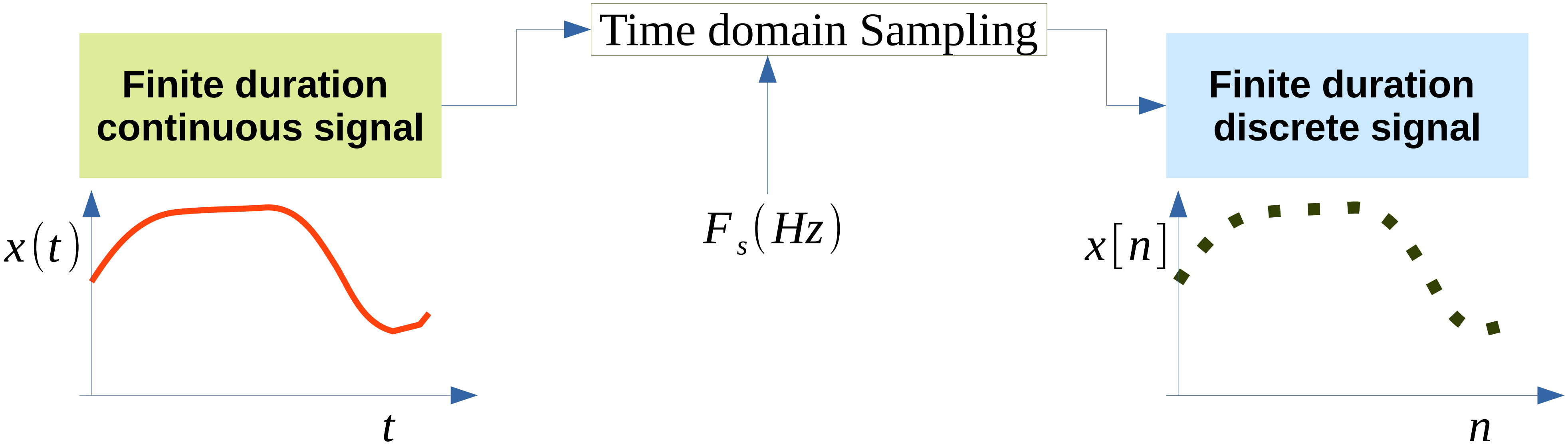
Sampled sinusoidal signal, various sequences and different arithmetic operations

Objective -

1. **Sampling of a continuous signal**
2. **Different arithmetic operations on discrete time signals**

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 1: Illustration of Continuous Signal Sampling



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

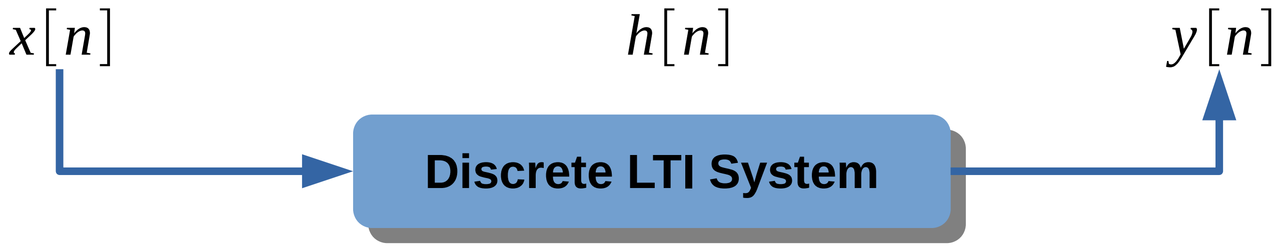
Experiment - 2

Convolution of two sequences using graphical methods and using commands verification of the properties of convolution

<u>Objective</u> -

1. Understand the principle of linear convolution between two finite sequences
2. Compute the discrete LTI system output

Experiment – 2: Linear Convolution



$$y[n] = x[n] * h[n]$$

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

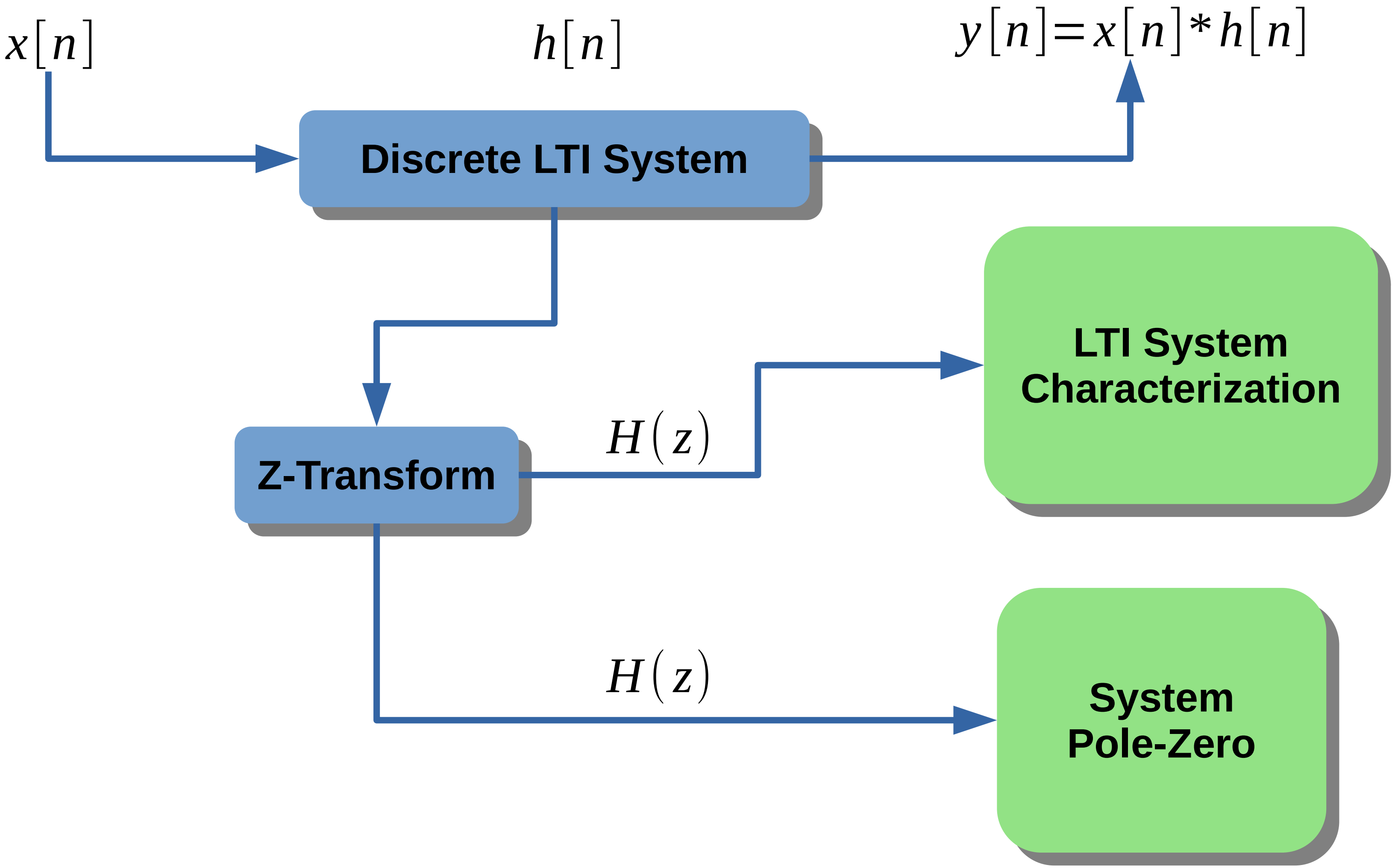
Experiment - 3

Z-transform of various sequences - verification of the properties of Z-transform

<u>Objective</u> -

1. Compute the Z Transform
2. Plot the pole and zeros of discrete LTI system
3. Find the frequency response of discrete LTI system

Experiment – 3: Z Transform & LTI system



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment - 4

Twiddle factors - verification of the properties

Objective -

1. Compute the Twiddle factor
2. Study the properties of Twiddle factor

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 4: Twiddle Factor Matrix

$$[X]_{(N,1)} = [W_N]_{(N,N)} [x]_{(N,1)}$$

$$w_N = e^{-j\frac{2\pi}{N}}$$

$$W_N = \begin{pmatrix} 1 & 1 & 1 & . & . & 1 \\ 1 & w_N^1 & w_N^2 & . & . & w_N^{(N-1)} \\ 1 & w_N^2 & w_N^4 & . & . & w_N^{2(N-1)} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ 1 & w_N^{(N-1)} & w_N^{2(N-1)} & . & . & w_N^{(N-1)(N-1)} \end{pmatrix}$$

Experiment - 5

DFTs / IDFTs using matrix multiplication and also using commands

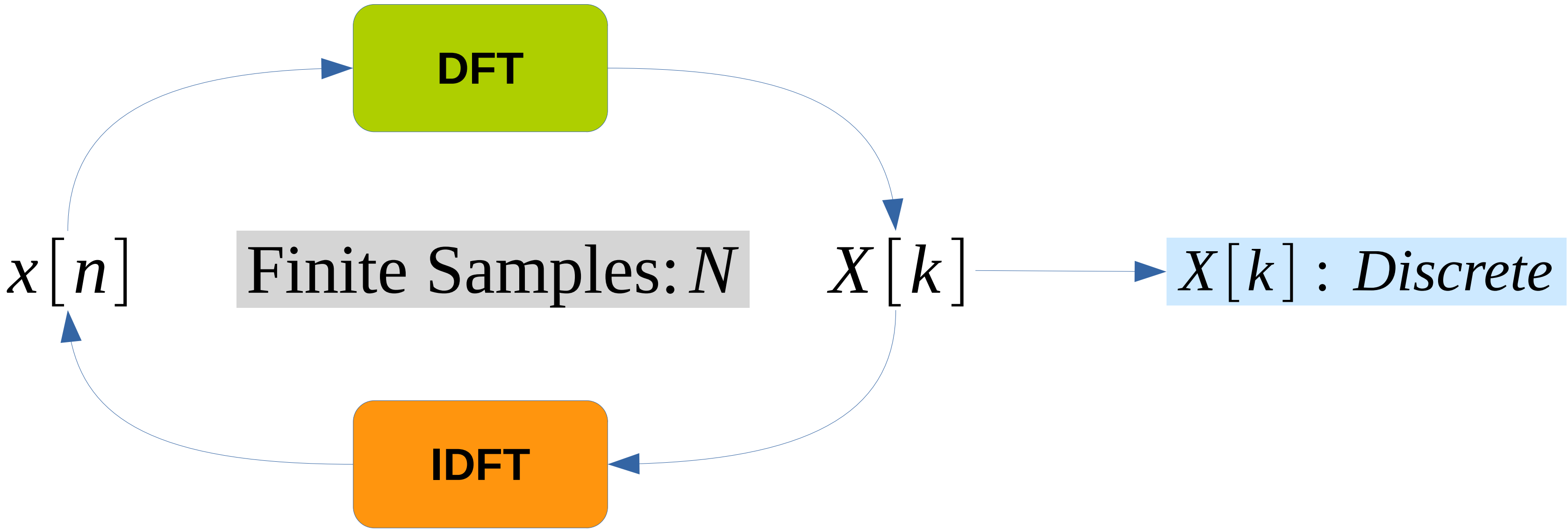
Objective -

1. Study the discrete spectrum of discrete time signal
2. Generate the discrete time signal from spectrum

Experiment – 5: DFT, IDFT

$$X[k]=\sum_{n=0}^{N-1} x[n]e^{-j2\pi kn/N}\,;\; 0\leq k<N-1$$

Analysis Equation

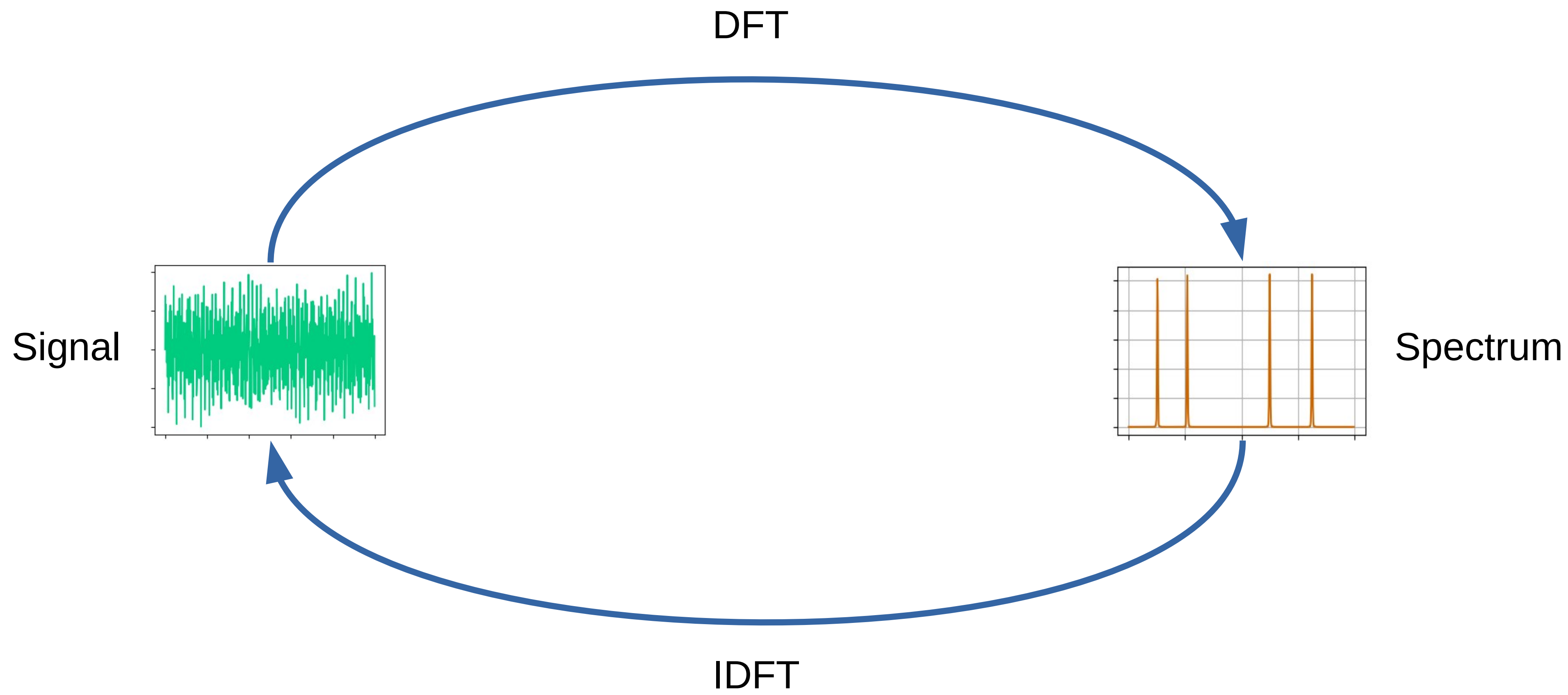


$$x[n]=\frac{1}{N}\sum_{k=0}^{N-1} X[k]e^{j2\pi kn/N}\,;\; 0\leq n\leq N-1$$

Synthesis Equation

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 5: DFT, IDFT



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

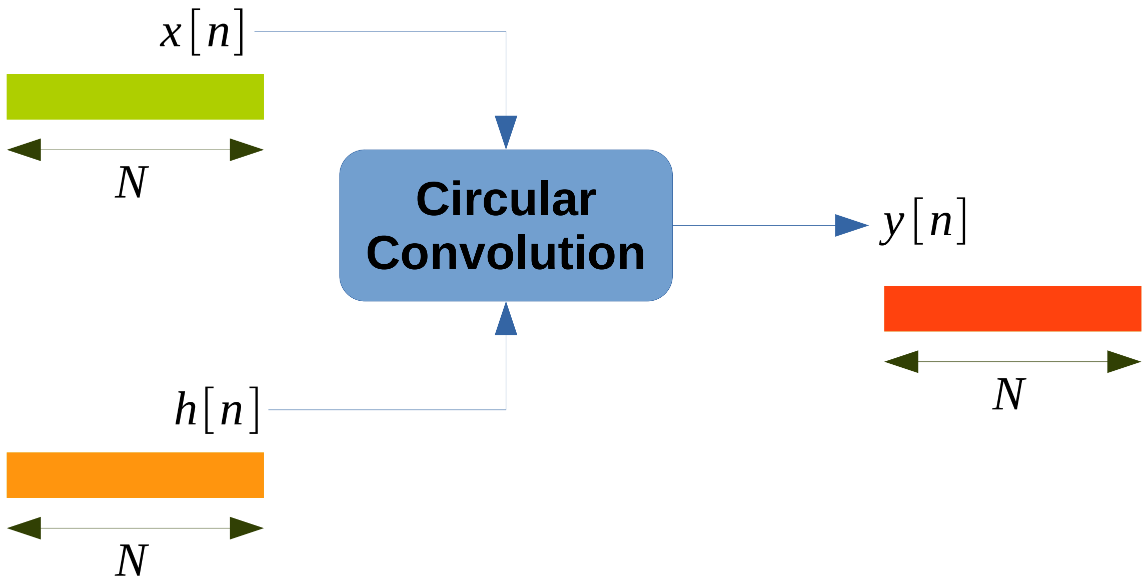
Experiment - 6

Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions

Objective -

1. Understand the principle of circular convolution between two finite sequences
2. Compute the discrete LTI system output
3. Understand the relation between linear and circular convolution

Experiment – 6: Circular Convolution



$$y[n]=\sum_{k=0}^{N-1} x[k]\,h[\langle n-k\rangle_N],\quad 0<n<N-1$$

Experiment - 7

Verifications of the different algorithms associated with filtering of long data sequences and Overlap -add and Overlap-save methods

Objective -

1. Filtering long data sequence for real-time aplication

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 7: OLA

Preprocess : Divide input data into frames of length : L

Frame output

$Step-1:$ Append : $N-M$ zeros to $h[n]$

M $\quad$ $N=L+M-1$

$Step-2:$ Append : $N-L$ zeros to $x_i[n]$

L $\quad$ $N=L+M-1$

$\# Frames$

DFT

$Step-3:$ Compute : $y_i[n]$

$N=L+M-1$

$Step-4:$ Add the overlap samples between successivce output frames to form the final output

$\# Frames * L+M-1$

Combiner

Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 7: OLS

Preprocess: Divide input data into frames of length : L

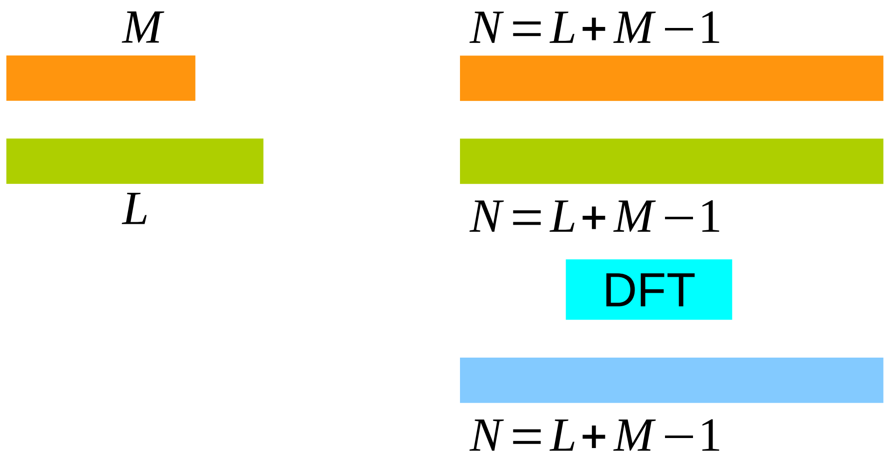
Frame output

Step−1: Append : $N-M$ zeros to $h[n]$

Step−2: Last $N-L$ samples from $x_{i-1}[n]$

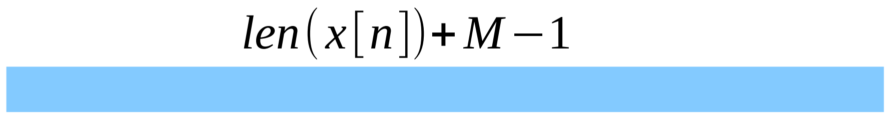
Step−3: Compute : $y_i[n]$

\# *Frames*



Step−4: Discard the first $N-L$ samples from each output frame to form the final output

Combiner



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

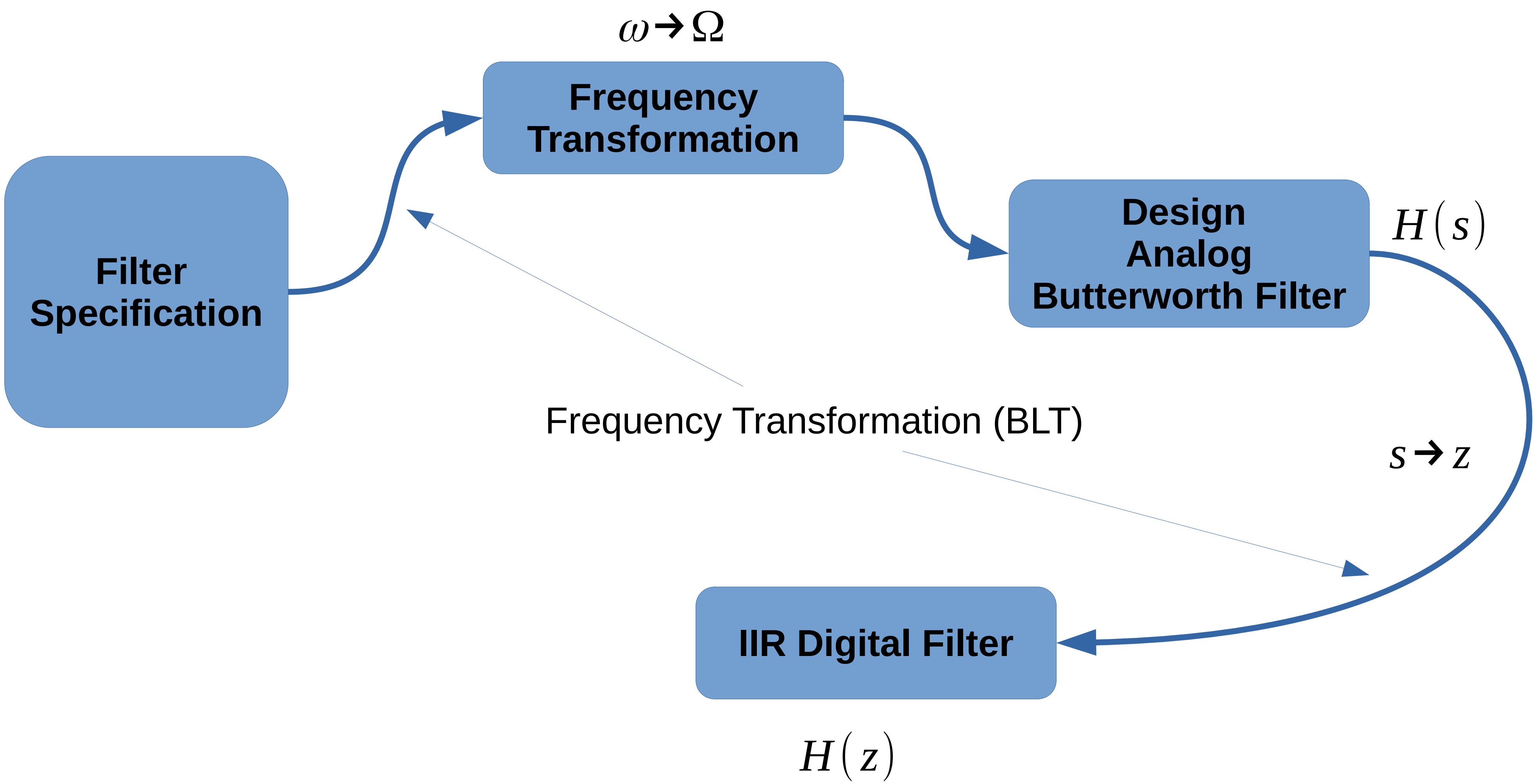
Experiment - 8

Butterworth filter design with different set of parameters

Objective -

1. Design and implement IIR filter with given specification

Experiment – 8: IIR Filter



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

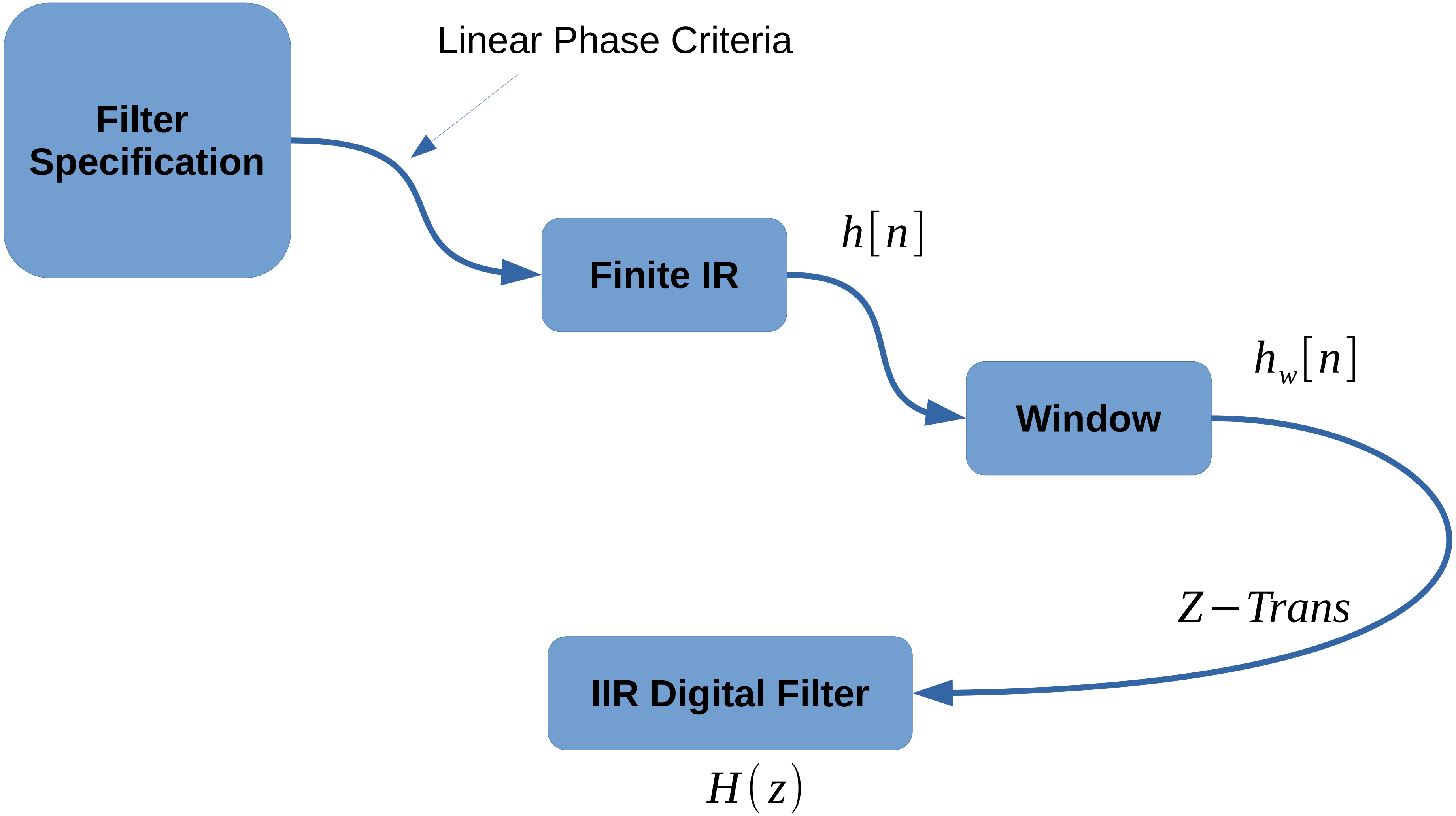
Experiment - 9

FIR filter design using rectangular, Hamming and Blackman windows

Objective -

1. **Design and implement FIR filter with given specification**
2. **Understand the effect of window in FIR filtering**

Experiment – 9: FIR Filter



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

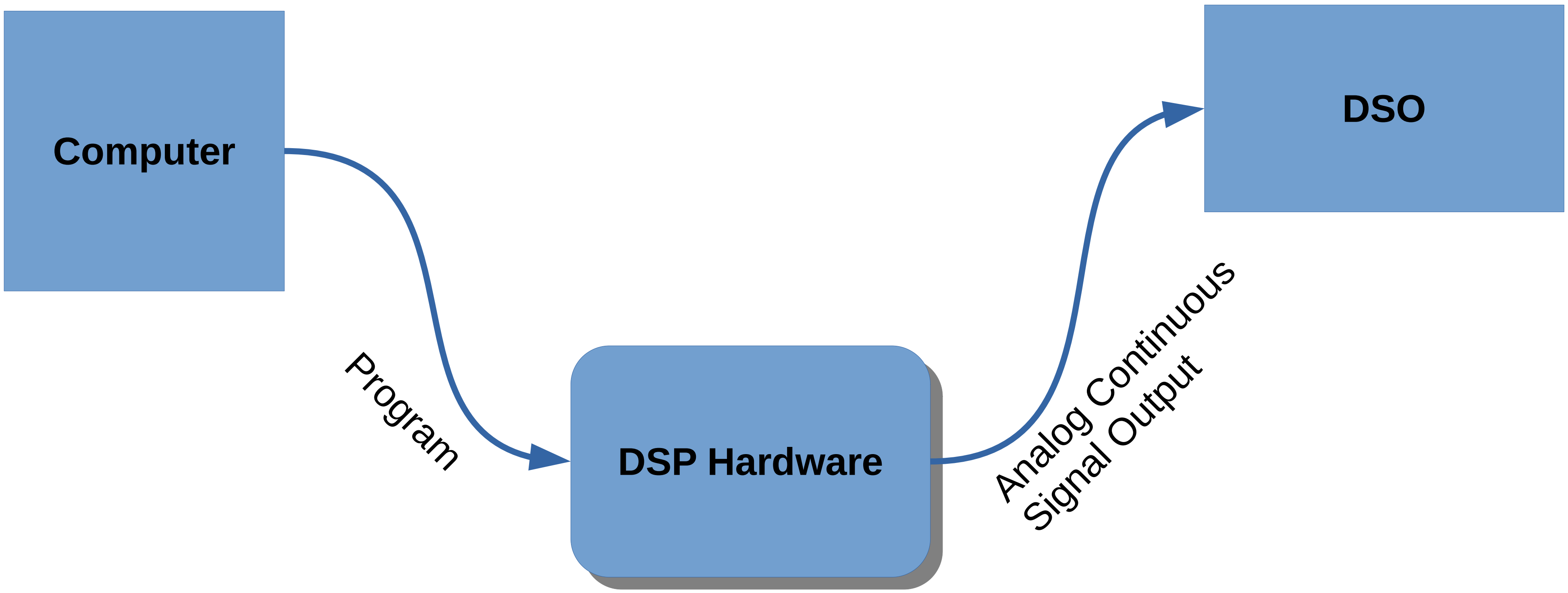
Experiment - 10

Hardware Laboratory using DSP Processor

Objective -

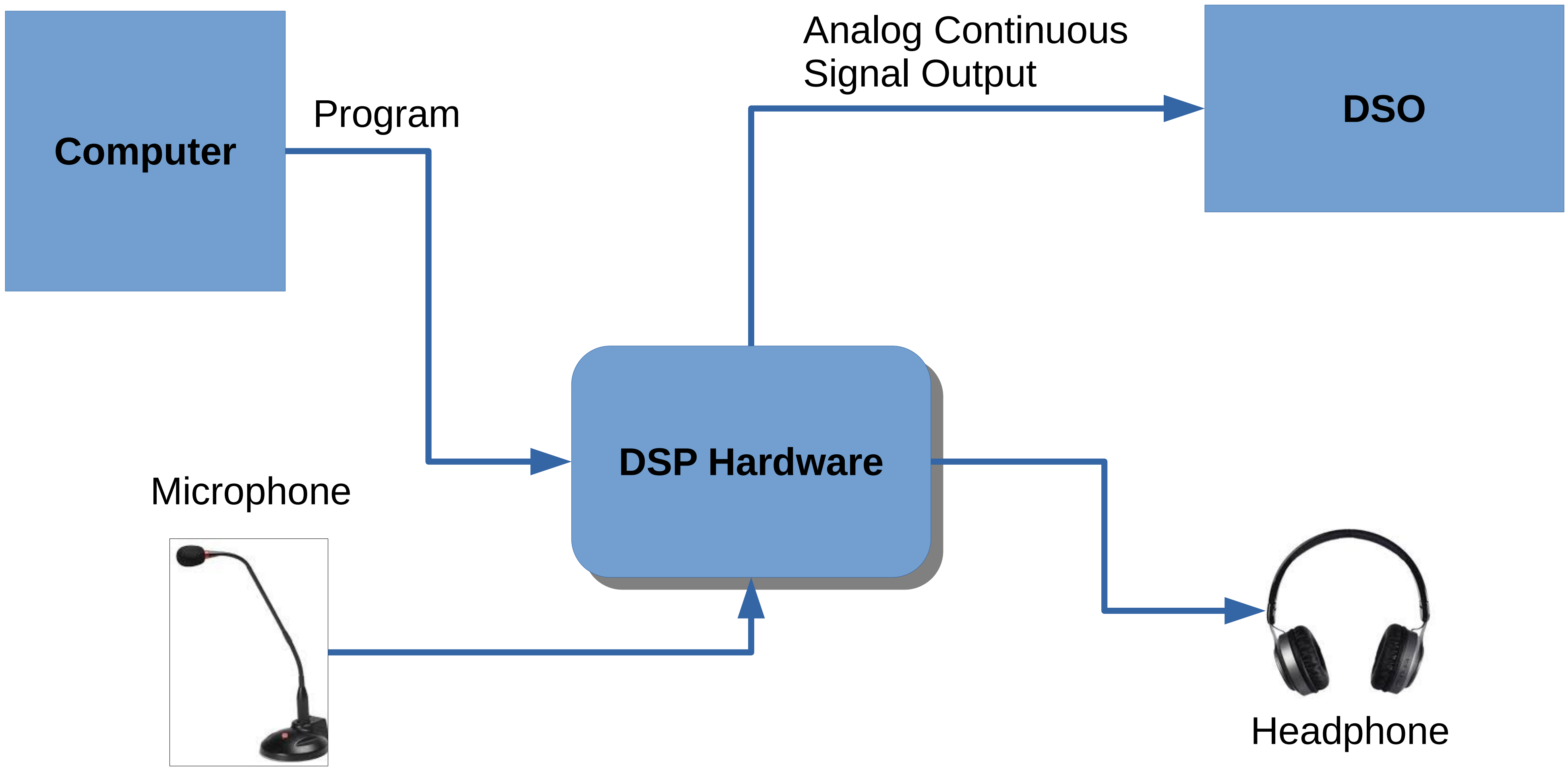
1. Generation of Sinusoidal wave from digital hardware
2. Sample real-time audio signal using digital hardware and display in oscilloscope
3. Real-time audio signal filtering

Experiment – 10: Sinusoidal Signal Generation



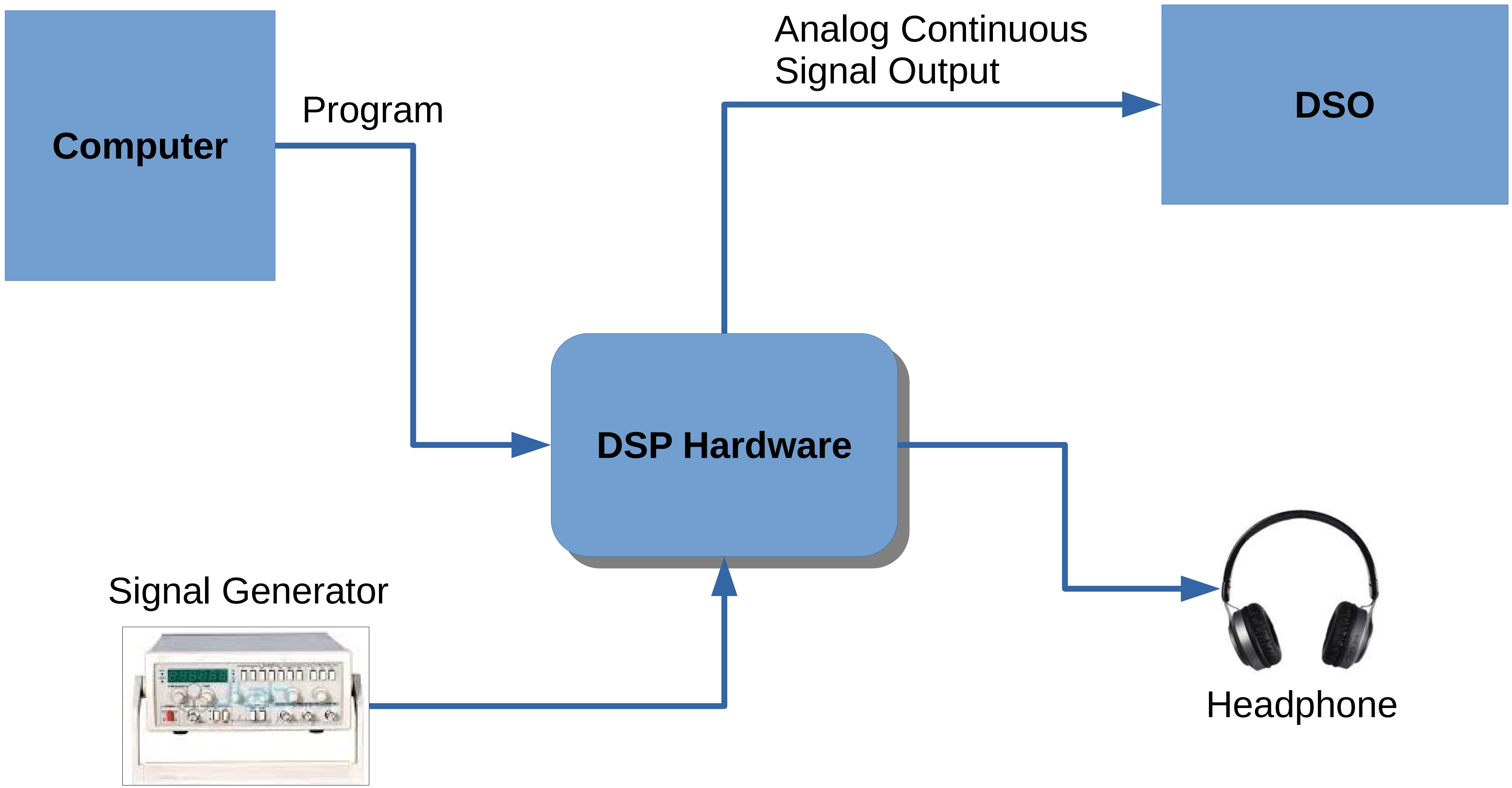
Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 10: Real-time signal sampling and output



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT

Experiment – 10: Real-time audio signal filtering



Compiled by – Mr. Sujoy Mondal, Dept of ECE RCCIIT